

# PATENT ABSTRACTS OF JAPAN

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## (54) LIGHTING SYSTEM FOR BACK LIGHT

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To give a divergence effect and prevent brightness non-uniformity generated when a reflection index is improved by employing a reflection process to be applied to an back face side of a light guide plate as a linear reflection cut along an axis of a fluorescent lamp and employing one surface of a divergence plate as a rugged face parallel to the axis of the fluorescent lamp.

**SOLUTION:** A reflection process 3 to be applied to a back face 2a side of a light guide plate 2 made of crystal resin is cut in a reverse V-letter shape and employed as a reflection cut 3a. The reflection cut 3a is linear along the axis of a fluorescent lamp 4, an interval of the cut 3a is narrowed as it is distant from an end face 2b, and an illumination distance generated is corrected by means of the distance from the lamp 4. One surface of a divergence plate 5 forms the rugged face 5a parallel to the axis of the lamp 4. A light that reaches from the lamp 4 to the reflection cut 3a, substantially all of which is reflected, is directed to an irradiation face 2c side, however, external radiation reflected on the inner face by means of the rugged face 5a of the divergence plate is generated, and brightness non-uniformity is eliminated.



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**\* NOTICES \***

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

**CLAIMS**

[Claim 1] In the lighting system for back lights which consists of the light guide plate with which it was formed in the rectangle by the transparent member, and reflective processing was performed to the tooth-back side, a fluorescent lamp which a shaft is made for there to be along the end side of this light guide plate, and is prepared in it, and a diffusion plate which is wearing the field by the side of the lighting of the aforementioned light guide plate, and is formed It is the lighting system for back lights which reflective processing performed to the tooth-back side of the aforementioned light guide plate is considered as the linear reflective cut in alignment with the shaft of the aforementioned fluorescent lamp, and is characterized by having made the aforementioned diffusion plate into the concavo-convex field which is parallel to the shaft of the aforementioned fluorescent lamp in one [ at least ] front face.

[Claim 2] The aforementioned concavo-convex field is a lighting system for back lights according to claim 1 characterized by having considered as the sign wave configuration.

[Claim 3] The aforementioned concavo-convex field is a lighting system for back lights according to claim 1 characterized by having considered as the shape of a triangular waveform which made the vertical angle larger than 90 degrees.

**FIELD OF INVENTION**

[The technical field to which invention belongs] In order that this invention may raise the reading performance of display in which it does not have spontaneous light functions, such as a LCD, it is related with the lighting system made into the shape of a field prepared in tooth backs, such as the aforementioned LCD.

**DETAILED DESCRIPTION**

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] In order that this invention may raise the reading performance of display in which it does not have spontaneous light functions, such as a LCD, it is related with the lighting system made into the shape of a field prepared in tooth backs, such as the aforementioned LCD.

[0002]

[Description of the Prior Art] It is drawing 4 which shows the example of the configuration of this conventional kind of lighting system for back lights 90. this lighting system for back lights 90 The light guide plate 91 with which it was formed in the shape of [ which has proper thickness by the transparent resin ] a rectangle, and reflective processing 92 was performed to the tooth-back 91a side, It consists of a

fluorescent lamp 93 which a shaft is made for there to be, one end-face 91b, i.e., the board thickness side, of the aforementioned light guide plate 91, and is arranged in it, and a diffusion plate 94 which covers field 91c by the side of the lighting of the aforementioned light guide plate 91, and is formed.

[0003] Here, by forming dot 92a in tooth-back 91a of a light guide plate 91 for example, by the printing means

etc. by the member which has a reflex function, at this time, the aforementioned reflective processing 92 shall

be supposing that it is dense, and shall illuminate the whole surface of the liquid-crystal-display element 20 with the uniform illuminance as distance separates the density of the aforementioned dot 92a from end-face 91b in which the aforementioned fluorescent lamp 93 was arranged.

[0004]

[Problem(s) to be Solved by the Invention] However, in the above mentioned conventional lighting system for back lights 90, if a mirror plane etc. makes the aforementioned dot 92a what has a high reflection factor, the reflected light will concentrate on the upper fraction of dot 92a, it will become that from which diffusion area sufficient in the fraction of which the density consists with \*\* is not obtained, and this will produce illuminance nonuniformity for the lighting to aforementioned LCD 20.

[0005] In order to solve this point therefore, the aforementioned dot 92a For example, while the trouble where become what must be formed by the strong member of a diffusibility to the reflected lights, such as white ink, the lighting brightness to LCD 20 falls, and the luminous efficacy as a lighting system for back lights 90 falls is produced The trouble where illuminance nonuniformity still remains also as a strong member of a diffusibility as mentioned above is produced, and the resolution of these points has considered as the technical problem.

[0006]

[Means for Solving the Problem] The light guide plate with which it was formed in the rectangle by the transparent member, and reflective processing was performed to the tooth-back side as a concrete means for this invention solving the aforementioned conventional technical problem, In the lighting system for back lights which consists of a fluorescent lamp which a shaft is made for there to be along the end side of this light guide plate, and is prepared in it, and a diffusion plate which is wearing the field by the side of the lighting of the aforementioned light guide plate, and is formed A technical problem is solved by offering the lighting system for back lights characterized by considering reflective processing performed to the tooth-back side of the aforementioned light guide plate as the linear reflective cut in alignment with the shaft of the aforementioned fluorescent lamp, and having made the aforementioned diffusion plate into the concavo-convex field which is parallel to the shaft of the aforementioned fluorescent lamp in the front face by the side of a lighting.

[0007]

[Embodiments of the Invention] Below, this invention is explained in detail based on the operation gestalt shown in drawing. It is the lighting system for back lights concerning this invention which is shown in drawing 1 with a sign 1. this lighting system for back lights 1 The reflective processing 3 performed to the tooth-back 2a side of the light guide plate 2 formed by the transparent resin, and this light guide plate 2, The point which is what consists of a fluorescent lamp 4 which a shaft is made to meet one end-face 2b of the aforementioned light guide plate 2, and is arranged in it, and a diffusion plate 5 arranged at the irradiation side 2c side of the aforementioned light guide plate 2 is the same as that of the thing of the conventional example.

[0008] In this invention, the reflective processing 3 performed to the tooth-back 2a side of the aforementioned light guide plate 2 here It is referred to as reflective cut 3a which performs and prepares a \*\*\*\* [ of V characters ]-like infed in the aforementioned tooth-back 2a directly, and the aforementioned reflective cut 3a is made into the line in alignment with the shaft of the aforementioned fluorescent lamp 4 at this time. Spacing D between the reflective cut 3a is having the illuminance difference which it shall be narrowed as it becomes far from end-face 2b in which the fluorescent lamp 4 was arranged, and a density shall be raised, and is produced according to the distance from a fluorescent lamp 4 rectified.

[0009] In addition, raising the above-mentioned density of reflective cut 3a. Namely, since it is increasing the area of the reflector which should make the light from the aforementioned fluorescent lamp 4 go to an irradiation side 2c side. It may correspond to correction of an illuminance difference by making deep the depth of the above mentioned infed of reflective cut 3a, or the both sides of spacing D and the depth of an infed may be changed, and you may correspond.

[0010] Moreover, although one [ at least ] front face of the aforementioned diffusion plate 5 is set to concavo-convex field 5a which has regularity and the example which prepared concavo-convex side 5a in the field by the side of the liquid-crystal-display element 20 of the aforementioned diffusion plate 5 shows with this operation gestalt in this invention, this may be a field by the side of a light guide plate 2. Furthermore, as explained also later, you may be the field of both sides.

[0011] And the aforementioned concavo-convex field 5a is made into Yamabe, i.e., the configuration which the summit of a sign wave configuration follows, in the orientation which a sign wave configuration shall appear in the cross section of the orientation which intersects perpendicularly with the shaft of the aforementioned fluorescent lamp 4, and is parallel to the shaft of the aforementioned fluorescent lamp 4. In addition, it is the reflecting mirror for reflecting the light emitted toward the orientation of a perimeter from the aforementioned fluorescent lamp 4, and carrying out incidence into a light guide plate 2 efficiently from the aforementioned end-face 2b which is shown with a sign 6 all over drawing.

[0012] Subsequently, the operation and effect of the lighting system for back lights 1 of this invention which were considered as the above-mentioned configuration are explained. First, the refractive index of the member in which this reflective cut 3a was formed in of the infed to tooth-back 2a as expanded and shown in drawing 2, and the light guide plate 2 was formed when explaining the aforementioned reflective cut 3a, since reflex is performed by the internal reflection by the difference with the refractive index of air, the light which reaches reflective cut 3a from the aforementioned fluorescent lamp 4 will be in the status of the so-called specular reflection that all the \*\* \*\*s are reflected, its reflective luminous efficacy improves, it is markedly alike, it increases and the amount of reflected lights goes to an irradiation side 2c side

[0013] In the fraction near end-face 2a in which the aforementioned fluorescent lamp 4 is arranged at this time, since spacing D between the aforementioned reflective cut 3a is large, it becomes what has high possibility of producing illuminance nonuniformity by the above-mentioned reflective luminous efficacy having improved at irradiation side 2c. However, by the front face by the side of the irradiation side of the aforementioned diffusion plate 5 being set to concavo-convex field 5a, change is produced at the angle in contact with the atmospheric air, and it changes with that from which the diffusion more than the diffusion which the diffusion plate 5 originally has by the refraction operation by the interface is obtained.

[0014] By the front face by the side of the irradiation side of the above-mentioned diffusion plate 5 having been set to concavo-convex field 5a, simultaneously from reflective cut 3a to light. Become what produces what performs internal reflection by the aforementioned concavo-convex side 5a partially, and it is once alike, and reflects in concavo-convex side 5a. What is emitted outside is produced from the position which shifted to the longitudinal direction in the state of illustration, it becomes that to which light is emitted also from the fraction beyond the domain which the light from reflective cut 3a has attained directly by this (refer to the drawing 2), and, thereby, illuminance nonuniformity is canceled. In addition, it is desirable to adjust to optimize pitch P of the aforementioned concavo-convex field 5a in actual operation, so that occurrence of the aforementioned brightness nonuniformity may be made into a minimum thing etc.

[0015] Although it is the important section of another operation gestalt of this invention which is shown in drawing 3 and it made concavo-convex field 5a of the front face by the side of the irradiation side of the aforementioned diffusion plate 5 the thing of a sign wave configuration with the front operation gestalt, it makes vertical-angle alpha the shape of a triangular waveform larger than 90 degrees for concavo-convex field 5b with this operation gestalt. in addition, about the aforementioned reflective cut 3a, the front operation gestalt is completely resembled, and it is the same configuration

[0016] At this time, the aforementioned concavo-convex side 5b in the cross section which intersects

perpendicularly with the shaft of a fluorescent lamp 4 Since it changes with what is constituted as a straight line of the letter of a \*\* face crease, while, as for the reflected light from the aforementioned reflective cut 3a, refraction and a diffusion are performed by prism operation of the aforementioned concavo-convex field 5b The diffusion by internal reflection is also performed, it changes with that from which the diffusion more than the diffusion which the diffusion plate 5 originally has like the front operation gestalt is obtained, and illuminance nonuniformity is canceled.

[0017] in addition, by concavo-convex field 5a (5b) preparing in one field of the diffusion plate 5, as explained above in actual operation, when the request of the dissolution of illuminance nonuniformity is inadequate It is good also as what prepares concavo-convex side 5a (5b) in both sides of the aforementioned diffusion plate 5, and is good in this case also considering both both sides as the shape of a sign wave configuration or a triangular waveform, or is good in one side also considering a sign wave configuration and another side as the shape of a triangular waveform.

[0018]

[Effect of the Invention] As explained above, reflective processing performed to the tooth-back side of a light guide plate is considered as the linear reflective cut in alignment with the shaft of a fluorescent lamp by this invention. A diffusion plate is having made the front face by the side of a lighting into the lighting system for back lights made into the concavo-convex field which is parallel to the shaft of the aforementioned fluorescent lamp. When considering as the status that the reflective cut which performs \*\* \*\* total reflection at the tooth back of a light guide plate, and is excellent in reflective luminous efficacy was given The extremely excellent effect of offering the bright lighting system for back lights as what prevents the brightness nonuniformity produced when the diffusion more than the conventional diffusion plate is given to this diffusion plate in respect of the irregularity formed in the diffusion plate and the reflective luminous efficacy of reflective processing is raised is done so.

## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the cross section showing the operation gestalt of the lighting system for back lights concerning this invention.

[Drawing 2] It is explanatory drawing showing an operation of the same operation gestalt.

[Drawing 3] It is the cross section showing another operation gestalt of the lighting system for back lights which similarly starts this invention in an important section.

[Drawing 4] It is explanatory drawing showing the conventional example.

[Description of Notations]

- 1 .... Lighting system for back lights
- 2 .... Light guide plate
- 2a .... Tooth back
- 2b .... End face
- 2c .... Irradiation side
- 3 .... Reflective processing
- 3a .... Reflective cut
- 4 .... Fluorescent lamp
- 5 .... Diffusion plate
- 5a, 5b .... Concavo-convex side
- 6 .... Reflecting mirror
- D .... Spacing of a reflective cut
- P .... Pitch of a concavo-convex side
- alpha .... Vertical angle

(At this point we had a power outage, and I was not able to download the drawings.)